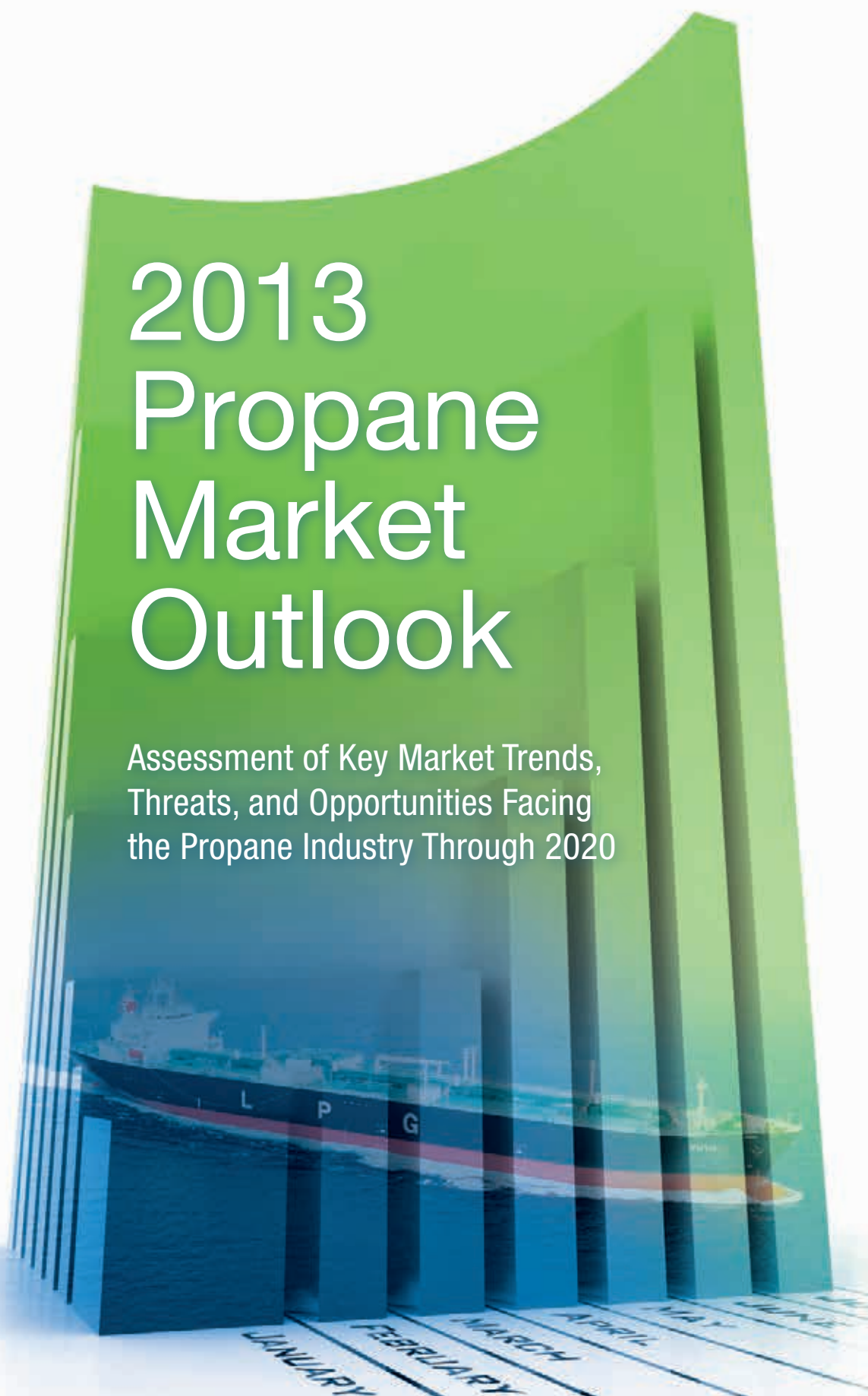




2013 Propane Market Outlook

Assessment of Key Market Trends,
Threats, and Opportunities Facing
the Propane Industry Through 2020

PRESENTED BY:



Propane Market Outlook at a Glance

- Total consumer propane sales declined by more than 17 percent between 2009 and 2012, including 3.3 percent in 2011 and 10 to 12 percent in 2012. The declines in 2011 and 2012 were due primarily to much warmer than normal weather, as well as the impact of higher propane prices and continuing efficiency trends. Sales are expected to rebound in 2013 with a return to more typical temperatures.
- Since 2010, propane prices have fallen substantially relative to other transportation fuels. The average price difference between major market prices for gasoline (New York Harbor gasoline price) and propane (Mt. Belvieu propane price) has increased by more than \$0.76 per gallon, from \$0.37 per gallon in 2010 to \$1.12 per gallon in 2012.
- Propane prices are expected to remain very competitive with gasoline, diesel fuel, and distillate fuel oil as propane supply continues to increase.
- Markets for internal combustion engines offer long term potential for large growth in propane sales, as clean propane applications including commercial lawn mowers, irrigation pumps, and propane vehicles become more widely available.
- The residential new construction market remains depressed, with new housing starts slowly rebounding from their 2009 lows.
- Fuel oil conversions in the Northeast may offer the highest growth potential in the residential and commercial sectors.
- Targeting existing propane customers to maximize household propane applications may be the most efficient way to offset continuing declines in fuel use per customer.
- Sales are projected to grow slowly from 2013/2014 to 2020 due to a rebound in the economy and introduction of new propane applications, particularly propane vehicles and other engine applications.
- Taking advantage of the opportunities and minimizing the challenges that lie ahead will require concerted action by the industry as a whole, including investments in new technologies and participation in the national energy conversation.

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Changes in Propane Pricing Relationships

The growth in propane supply is changing fundamental energy price relationships; propane prices have fallen substantially relative to gasoline, diesel fuel, and home heating oil prices. As a result, propane has become more competitive in the markets where propane competes against these fuels. While propane prices relative to crude oil are expected to rebound from 2012 levels as new infrastructure, including new export capacity, is brought on-line, ICF expects propane prices relative to crude oil to remain well below historical averages for the foreseeable future. At the same time, domestic propane prices will not fully delink from oil prices, and competition against electricity and natural gas in traditional propane markets will remain very challenging.

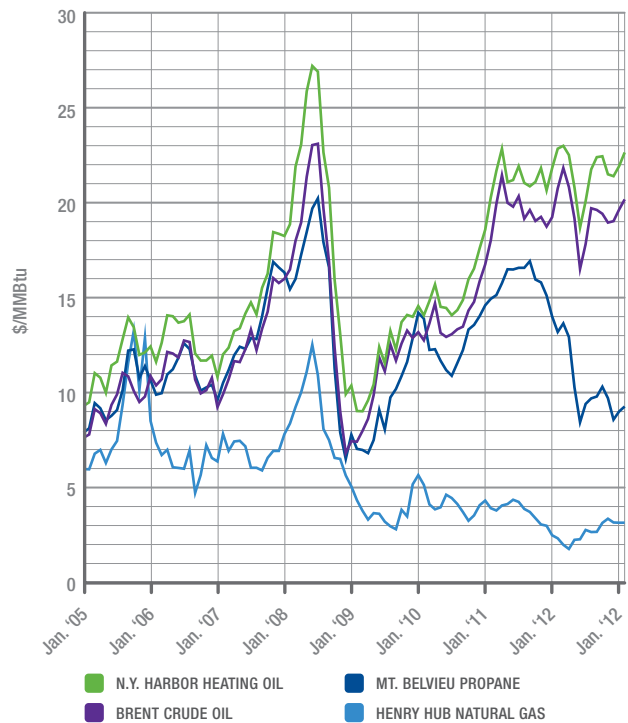
Outlook for Propane Demand

After peaking in 2003, nationwide consumer propane (odorized propane) demand fell by more than 10 percent through 2006. Although propane demand rebounded in 2007 and 2008 due to colder weather, propane consumption continued to decline in 2009, 2010, 2011, and 2012. (See Figure B)

The collapse of the new housing market and loss of residential market share to electricity in many regions, combined with decreases in fuel use per customer resulting from efficiency upgrades in homes and equipment, contributed to a decline in residential propane sales. The recession also reduced demand in the industrial and commercial sectors, which have yet to fully recover. The impact of these factors has been magnified by increases in retail propane prices, which peaked in 2011.

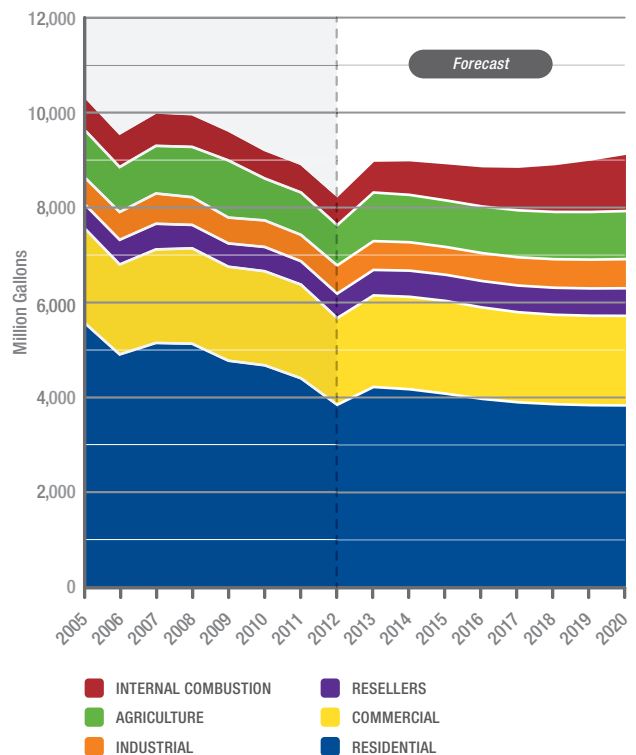
Consumer propane demand fell by 3.3 percent in 2011 relative to 2010. The decline was due to much warmer than normal temperatures during the fourth quarter of the year, as well as a continuation of load loss due to higher prices and improvements in energy efficiency in the residential and commercial sectors. 2012 was even warmer than 2011, leading to an additional decline in consumption of 10 to 12 percent.

Fig. A
Historical Spot Prices



Source: EIA

Fig. B
Near-Term Odorized Propane Consumption Forecast



Looking beyond 2012, the outlook is more optimistic. If weather returns closer to normal, propane sales should increase substantially in 2013. With normal temperatures, propane sales are projected to start to grow slowly in 2013/2014, and to continue to grow through 2020. The pace of growth will depend on development of and growth in the propane engine fuel markets. Aggressive growth in engine fuel applications will be necessary to offset continuing declines in the residential sector and other traditional propane markets.

Comparison with Previous Forecasts

This report is the third in a series of Propane Market Outlooks (PMO), which started in 2009. The previous versions of the PMO are available on the PERC Website at <http://www.propanecouncil.org/about/metrics-initiative/>. While the key drivers of propane demand have been relatively consistent across all of the versions of the PMO, the outlook for propane demand growth has changed over time. The current demand forecast is less optimistic than the 2010 forecast. The

rebound in the economy and in the housing market has been slower than projected. In addition, oil and propane prices have been higher than expected, resulting in decreased demand relative to previous forecasts.

However, recent developments have improved the outlook for propane use in internal combustion engines. These developments include the availability of new emissions-certified engines, widening spreads between propane and conventional fuel prices, and the growing acceptance of propane vehicles by commercial vehicle fleet operators. With crude oil, gasoline, and diesel fuel prices projected to remain high to the end of the decade, propane's price advantage should help drive continuing growth in the engine fuel segment. ICF is projecting propane vehicle sales to increase from fewer than 5,000 in 2011 to more than 40,000 per year by 2020, with the potential for much higher growth depending on national energy policy and the rate at which the propane industry chooses to develop propane refueling infrastructure and promote propane vehicle sales.



2 Critical Energy Market Trends

The U.S. propane industry is facing several fundamental changes in energy markets over the next few years. Growth in propane supply, volatile energy prices, evolving energy and environmental policies and regulations, and increased competition with electricity will all have major impacts on propane's competitive position.

2.1

Changes in Propane Supply

In recent years, a sea-change has taken place in North American propane supply. Three years ago, the propane market relied on imports to meet domestic demand. Today, domestic production exceeds demand, with exports rising as quickly as capacity will allow.

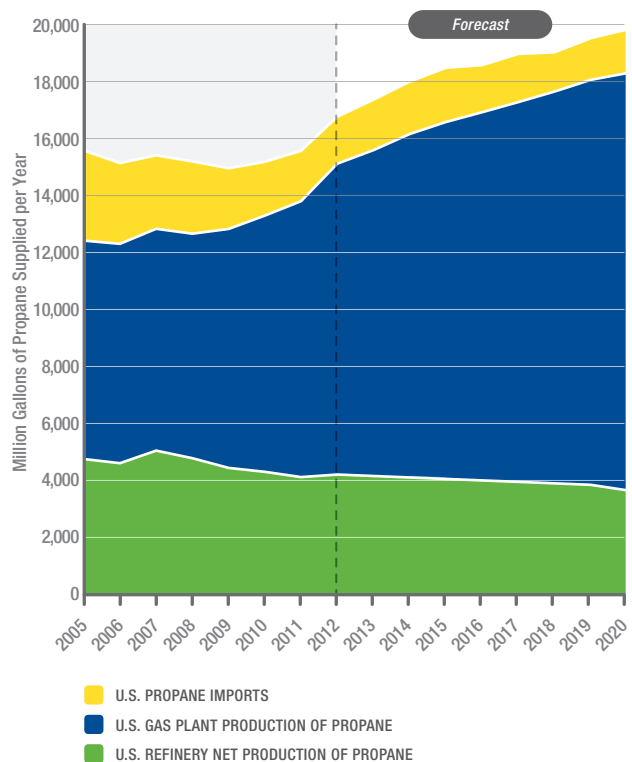
Between 2005 and 2011, U.S. production of propane from natural gas processing plants and refineries grew from 12.4 billion gallons to 13.8 billion gallons (See Figure C). The primary driver of this expanding supply has been the growth in propane production from domestic natural gas liquids, which increased from 7.7 billion gallons in 2005 (the lowest level since 1991) to 9.7 billion gallons in 2011. In 2012, the U.S. produced about 15 billion gallons of propane, including almost 11 billion gallons of propane from natural gas liquids.

This dramatic increase in production from gas processing plants has had a powerful impact on America's propane balance of trade. In 2005 the U.S. imported more than 20 percent of its total propane supply, including nearly 1.2 billion gallons of propane from outside North America, and an additional 2 billion gallons from Canada. By 2011, imports from outside North America declined to just over 300 million gallons, while imports from Canada declined to 1.5 billion gallons. However, the

Fig.

C

U.S. Historical and Forecasted Propane Supply



Sources: EIA, U.S. Department of Commerce, ICF

U.S. also exported 1.9 billion gallons, and became a net exporter of propane. In 2012, exports of propane grew substantially to about 2.6 billion gallons, leading to net exports of almost 1.0 billion gallons.

The changing supply picture has flipped propane's perceived place in the fuels basket. Long seen as a crude oil derivative, with the same supply security issues as other petroleum products, more than 70 percent of total U.S. propane supply now comes from domestic natural gas liquids production. In 2012, propane produced in the U.S. from domestic natural gas liquids and crude oil resources exceeded total consumer propane demand. Imports from outside the U.S. and Canada made up only about one percent of total supply, and about 11 percent of propane was produced in U.S. refineries from non-U.S. or Canadian crude oil. The U.S. exported about 15 percent of total propane supply.

ICF projects that these trends will continue. The outlook for refinery-supplied propane remains negative due to additional refinery shutdowns, the reorientation of others to focus on diesel and distillate production, and continued refinery emphasis on producing propylene instead of propane. ICF is projecting North American production of propane in association with natural gas liquids to increase from 13.4 billion gallons per year in 2012 to 15.6 billion gallons a year in 2015 and 18.1 billion gallons per year by 2020.

This increasingly positive outlook for domestic propane supply is primarily due to the continuing development of shale gas and unconventional oil resources. The increase in propane production from natural gas

liquids has also accelerated due to the shift in resource development activity from dry natural gas resources to wet gas and liquids resources.

Most of the new propane production is expected to go to markets other than U.S. consumer demand. As propane prices have fallen, petrochemical industry demand for propane has increased. The petrochemical industry is planning to significantly expand propane use in the future. Recently announced plans for new propane to propylene petrochemical facilities suggest that, by 2018, propane consumption in new facilities could increase petrochemical propane demand by an additional 2.3 billion gallons per year.

In addition, midstream companies, including Enterprise, Targa, Vitol, Phillips 66, and others have proposed development of new export capacity to meet demand in international markets with higher propane prices. The list on the following page shows some of the recently announced propane/butane export terminals, which, if all commissioned, would increase propane export nameplate capacity from 2.9 billion gallons per year in 2012 to as much as 16.8 billion gallons per year by 2018.

While today, most U.S. propane exports go to markets in Central and South America, much of the new capacity is slated to be available by 2015, when the Panama Canal expansion project is scheduled for completion, allowing Gulf Coast terminals easier access to the Asian market.

Despite the growth in petrochemical propane demand, propane exports are expected to continue to increase

Existing and Publicly Announced Planned Propane Dehydrogenation Plants

Company	Output Volume (tons/yr)	Propane Consumption (Mil. Gal./yr.)	Location	Start-up Year
PetroLogistics	640,000	460	Houston, TX	2010
PetroLogistics	640,000	460	Houston, TX	2014
Dow Chemical	750,000	540	Freeport, TX	2015
Enterprise	685,000	490	Chambers Co., TX	2015
C3 Petrochemicals	N/A	N/A	Alvin, TX	2015
Williams	500,000	360	Edmonton, AB	2016
Formosa Plastics	800,000	570	Point Comfort, TX	2016
Dow Chemical	550,000	380	TX/LA	2018
Total	4.6 million	3,260		

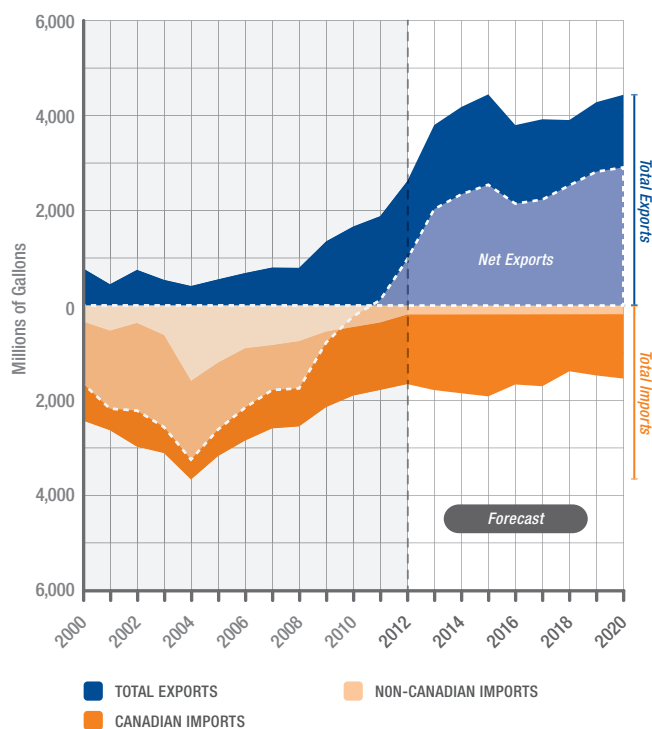
Existing and Proposed LPG Export Terminals

Company	LPG Export Capacity (Mil. Gal./yr.)	Location	Start-up Year
IN OPERATION ON JAN. 1. 2013			
Enterprise	2,076	Houston Ship Channel, TX	
Targa	756	Galena Park, TX	
Other	29	Miami, Norfolk, NY, Seattle, LA	
Total in Operations in 01/2013	2,851		
PROPOSED			
Enterprise	1,750	Houston Ship Channel, TX	2013 Q1
Targa	1,850	Galena Park, TX	2013 Q3
Vitol	1,500	Beaumont, TX	2014 Q4
Phillips 66*	6,500	Baytown, TX	2014
Sunoco Logistics	600	Marcus Hook, PA	2014 Q3
Pembina Pipeline Co.	600	Prince Rupert, BC (Canada)	2015 Q3
Occidental	1,150	Corpus Christi, TX	2017
Total Proposed	13,950		
Total in Operation + Proposed	16,800		By 2017

* Project unlikely to proceed.

Fig.

D U.S. Propane Export Projection to 2020



Sources: U.S. Department of Commerce, ICF

for the next few years. Figure D at left shows both historical and projected propane import/export balance. Exports are expected to increase to more than 4 billion gallons per year by 2015, before stabilizing as new petrochemical demand offsets growth in propane production. The net balance is the result of shifting domestic propane production, as well as historical and projected demand from consumer and industrial markets. Imports from Canada will remain relatively stable as Canadian production of propane stabilizes after several years of decline. The U.S. will continue to import marginal quantities of propane from other countries into specific markets, including New England due to occasional supply shortfalls.

2.2 Energy Prices World Oil Prices

Oil prices represent one of the greatest areas of uncertainty affecting the outlook for propane. Oil prices increased rapidly from 2001 to 2008, driving up propane prices and reducing propane's competitiveness in many markets. Although negative economic conditions reduced oil demand and caused prices to fall back to 2005 levels during 2009, crude oil prices moved back

above \$100 per barrel in 2011. Long term international demand for oil is expected to continue to increase, maintaining upward pressure on oil and petroleum product prices, as well as propane prices.

World oil prices are also expected to remain highly volatile. Much of the recent increase in crude oil prices has been the result of a significant risk premium added to market prices due to political instability in the Middle East and North Africa. Further instability in these regions likely would result in even higher oil prices and potentially dramatic price spikes.

In the past, propane prices have been very closely linked to oil prices in both domestic and international markets. This relationship is changing, but not disappearing, due to the growth in domestic propane supply. In 2012, high propane inventories due to warm winter weather, combined with growth in propane supply and constraints on propane export capacity pushed propane prices down to historically low levels relative to crude oil. As propane export capacity catches up to supply, domestic propane prices are expected to rebound. However, the change from an importer to an exporter of propane has shifted the fundamental relationship between domestic propane and crude oil prices.

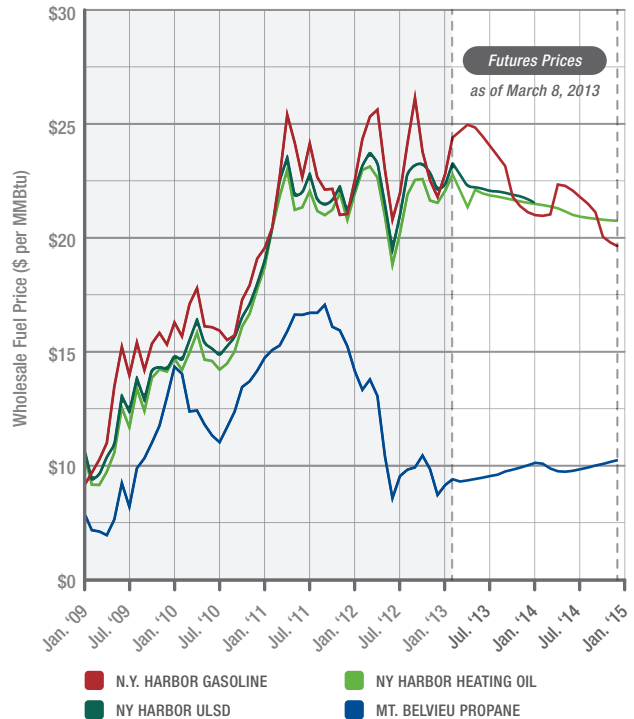
In the future, we anticipate the **ceiling** on domestic propane prices will be set at the world price of propane **minus** transportation costs to international markets, rather than the world price of propane **plus** transportation costs that set the **floor** on domestic propane prices during the periods when the U.S. was a major propane importer. In addition, the growth in U.S. exports, as well as growth in other international sources of propane is likely to put downward pressure on international propane prices relative to crude oil.

Petroleum Product Prices

Oil price volatility has carried over to petroleum product prices, including gasoline, heating oil, and ultra low sulfur diesel (ULSD).

While the price relationship between propane and crude tends to change from month to month, average 2012

Fig. E Propane, Heating Oil, ULSD, and Gasoline Wholesale Prices



Sources: EIA, NYMEX

propane spot prices at Mt. Belvieu¹ were 43 percent below the Brent² crude oil price when measured in dollars per MMBtu. This represents a significant decline relative to 2010, when propane prices were only 8 percent below the cost of Brent crude oil on a dollar per MMBtu basis. The impact on propane price of rapidly expanding supply and a declining consumer market, particularly due to the 2011/2012 “non-winter,” was pronounced.³ Propane prices declined from \$1.56 per gallon in September 2011 to below \$0.80 per gallon in July of 2012 before rebounding to between \$0.80 and \$1.00 per gallon during the second half of the year.

At the same time, the price of distillate fuel oil generally has been increasing relative to crude oil. The change in the relative fuel prices of both propane and distillate is a major shift away from the historic norms for both fuels.

¹ Mt. Belvieu is the largest propane storage facility in the U.S., and prices at Mt. Belvieu are generally accepted as the market price for propane. Regional propane prices will differ from Mt. Belvieu based on transportation costs and transportation constraints.

² The price of Brent crude is currently considered a marker price for world crude oil. Prices of other crude oils, including WTI (West Texas Intermediate) are generally linked to world crude oil prices based on transportation cost differences and differences in crude oil quality. In the past, WTI has been a marker price for crude. However, in the past two to three years, transportation infrastructure constraints have suppressed WTI prices relative to Brent and other crude oil prices.

³ During the 2011/2012 winter, the U.S. experienced 16% fewer heating degree days than during a “normal” winter.

The underlying trends in distillate fuel oil prices are determined by the international market. The economic slowdown reduced distillate demand and prices in the short term; however, international distillate demand is expected to grow, pushed higher by policies and taxes promoting the use of diesel. At the same time, the cost of distillate production is expected to increase due to tightening international environmental standards on sulfur content and changes in the international crude oil supply mix.

In addition, growth in worldwide propane supply is expected to exceed growth in non-petrochemical propane demand as major processing facilities come online in Qatar and other propane producing countries. These shifts in supply and demand indicate that distillate prices are likely to continue to remain high relative to propane prices over the next few years. As a result, propane is expected to remain very competitive with both diesel fuel and distillate fuel oil in U.S. markets.

In 2012, Mt. Belvieu propane prices averaged 43 percent of the price of Brent crude oil on a dollar per MMBtu basis, down from 8 percent below Brent in 2010 and 18 percent below Brent in 2011. During the same period, No. 2 Heating Oil maintained a relatively consistent premium of about 10 percent above Brent. This shift resulted in an increase in the wholesale price of fuel oil relative to propane of about \$8.30 per MMBtu, or about \$0.76 per gallon of propane.

This market shift is reflected in the current futures markets for both propane and fuel oil. The NYMEX futures market currently indicates that the participants in the market expect propane prices to rebound slowly relative to crude oil, while the price of distillate fuel oil is expected to continue to increase relative to crude oil. Overall, the futures market indicates a market

expectation that the differential between wholesale fuel oil and wholesale propane prices is expected to remain at historical highs through 2014.

This shift has also affected the relationship between propane and gasoline prices. Since 2010, the average price difference between major market marker prices for gasoline (New York Harbor gasoline price) and propane (Mt. Belvieu propane price) has increased by more than \$0.76 per gallon, from \$0.37 per gallon in 2010 to \$1.12 per gallon in 2012.

At today's prices, propane is extremely attractive relative to gasoline and diesel fuel in many engine fuel applications. ICF projects the difference between the prices of gasoline and diesel fuel and propane prices to decline slowly over time relative to today's levels, as markets continue to adjust to the growth in supply, leading to a continuation of the attractive economics for propane engine fuel applications for the foreseeable future.

Electricity Prices

In most residential and commercial markets, competition with electricity will continue to be a major challenge to growth in propane sales. Over the past 10 years, propane prices have increased relative to electricity prices in most geographic markets. However, electricity prices have also increased, dramatically in some areas.

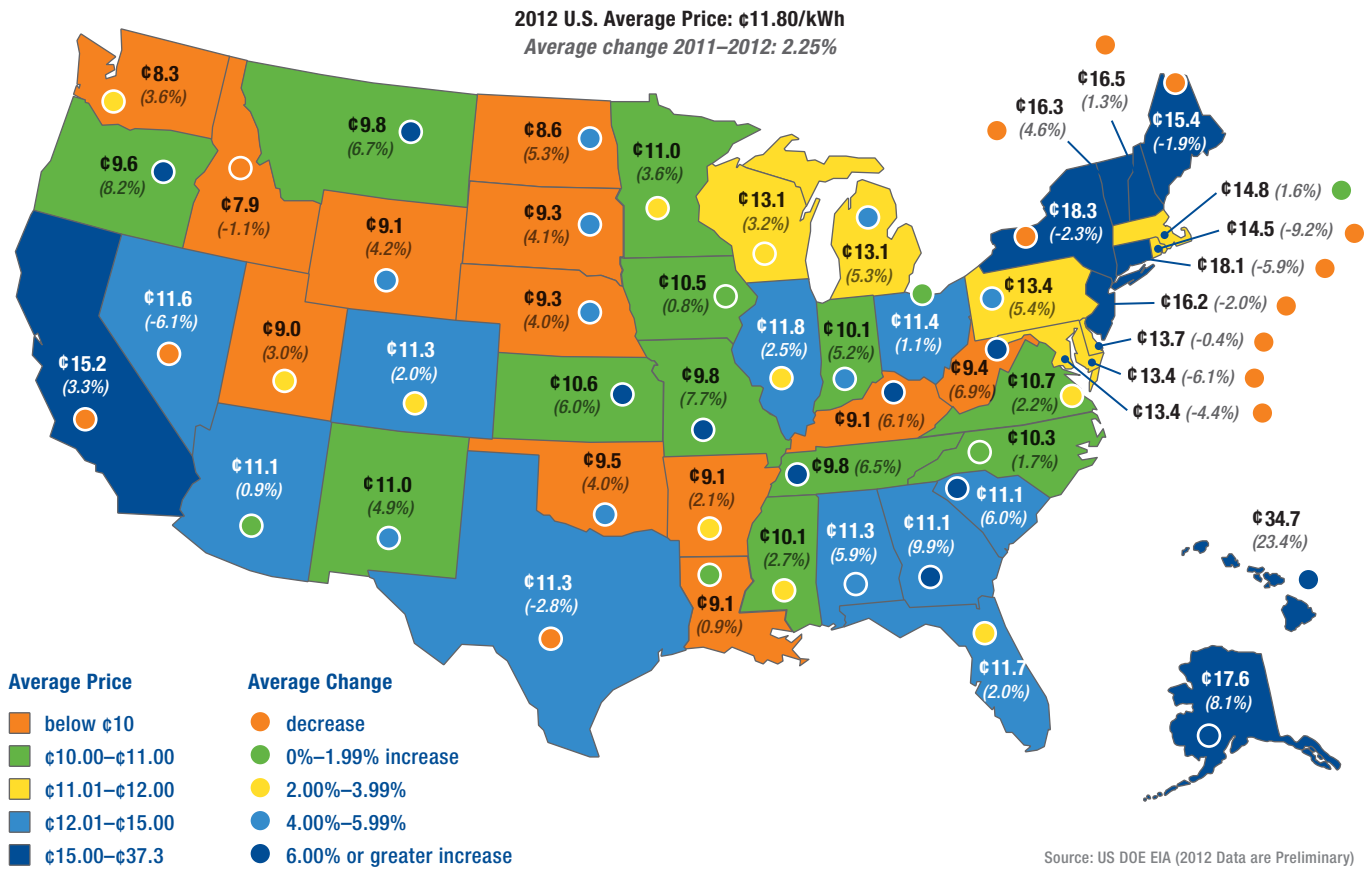
Electricity prices vary widely by region depending on market structure, generation types, and capacity constraints. The characteristics of electricity production lead to retail electricity prices that are generally more stable than those of other fuels. Hence, when energy prices are increasing, prices of other fuels can be expected to increase faster than electricity prices.



LPG Carrier Yuyo, photo courtesy of JX-Shipping of Tokyo, Japan

Fig.

F 2012 U.S. Residential Average Price (and change from 2011) per Kilowatthour



The price of electricity also varies widely by specific location. State average prices reflect the major factors driving prices in the state, but tend to be representative of the prices charged by utilities serving the major urban areas with the majority of electricity customers. Electricity prices in rural and suburban areas can diverge substantially from these state averages. Within a specific state, some markets are likely to see electricity prices as much as 40 percent higher or lower than the state average, with the higher prices often set by small municipal utilities that serve areas with a high concentration of propane customers. As a result, propane can be competitive with electricity in many communities even in states with relatively low average electricity prices.

Electricity prices are expected to rise slowly from their current levels in many states. However, ICF does not expect to see significant near-term improvement in the relationship between propane and electricity prices in any major market, and the softness in natural gas prices

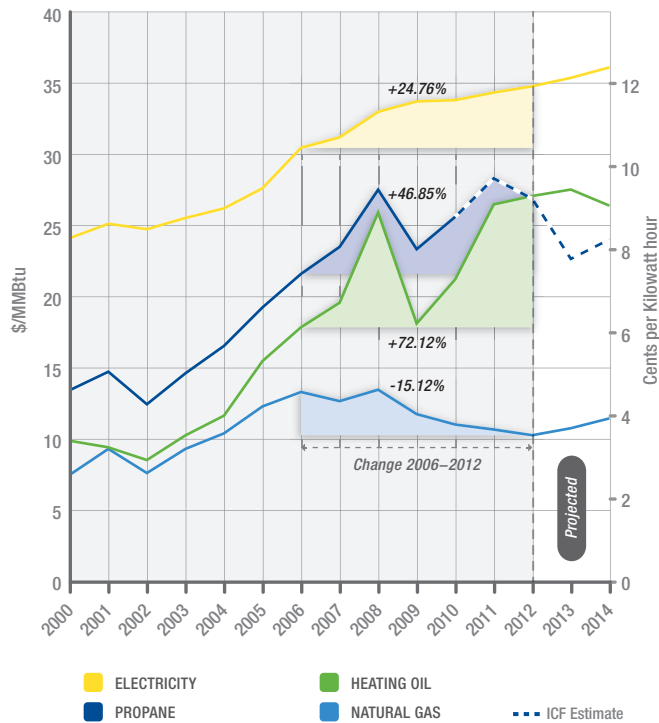
is beginning to translate into lower electricity prices in certain higher-cost markets such as New England and the Northeastern United States. In the longer term, increases in power generation investments related to implementation of emissions regulations is expected to lead to a slow increase in future electricity prices, but no fundamental impact on the competitive cost relationship between propane and electricity should be expected before 2020.

Near Term Residential Energy Price Outlook

The Energy Information Administration's (EIA) short-term residential energy price forecast, from January 2013, projects fuel oil prices to continue increasing from current levels through the end of 2013. While the EIA no longer projects residential propane prices, ICF estimates a steady decline from the peak prices in 2011. The EIA expects residential natural gas prices to rebound slightly from the lows of 2012, while electricity prices increase slowly (see Figure G).

Fig.

G U.S. Average Residential Prices



2.3

Competition with Electricity and Other Fuels

Propane’s share of the residential space heating market has been falling since 2007. Much of the loss in propane market share in the residential sector in recent years is attributable to competition with conventional electric heat pumps. This competition is expected to intensify over time for several reasons. Technology improvements are reducing heat pumps’ traditional shortcomings. New generation heat pumps are much more efficient than older units. In addition to improved operating characteristics at low temperatures, the heat output from new heat pumps has increased, improving the comfort they deliver. Equipment reliability and lifespan also have been improved. As heat pump technology continues to advance, it will remain a growing threat to the propane heating market.

Geothermal heat pumps (GHPs) represent a growing competitive challenge to propane in some key regional heating markets where conventional heat pumps traditionally have not been able to compete effectively with

propane. GHPs are designed to maintain high operating efficiency even when outside temperatures drop below 20 degrees Fahrenheit, which allows the technology to be competitive in colder environments where the conventional heat pump is unable to operate economically.

Until recently, market adoption of GHP technology was limited by the very high cost of installation. However, GHPs are now being aggressively marketed as a “green” technology and are currently eligible for a 30 percent income tax credit on the full installation cost. The U.S. Department of Agriculture also provides funding for rural electric cooperatives to install ground loops for GHP systems, with the costs recovered through a utility rate surcharge to the customer. These incentives have provided a significant boost to GHP installations in the past few years, and are expected to stimulate additional growth in GHP installations in the future.

The map in Figure H shows the fuel type with the largest increase in market share between 2009 and 2011 for each county. Overall, electricity’s share of the home heating market has been increasing rapidly, particularly in the South, but also in some northern states. The share of homes heated with wood has also been increasing in the last few years, particularly in New England and the upper Midwest. Many of these homes switched from propane and fuel oil to wood due to increased fuel prices. ICF believes that most of the homes that switched to wood from propane can heat with either energy source and can switch back to propane if consumers tire of using wood or if propane prices moderate.

Propane gained market share in 1,128, or 36% of U.S. counties between 2009 and 2011. Much of the growth in market share occurred in counties where fuel oil market share declined. However, in a surprising number of counties (see map in Figure I), propane increased market share at the same time that natural gas market share was declining. In these counties, the propane market was increasing due to new housing growth and conversions from other fuels, while the natural gas system was not expanding, or was losing share to electricity.

This trend is unlikely to continue as natural gas utilities, often supported by natural gas regulators and consumer advocates, use lower natural gas prices to justify expansion of natural gas distribution systems to additional consumers.

Fig.

H

Fuel with Largest Market Share Gains between 2009 and 2011

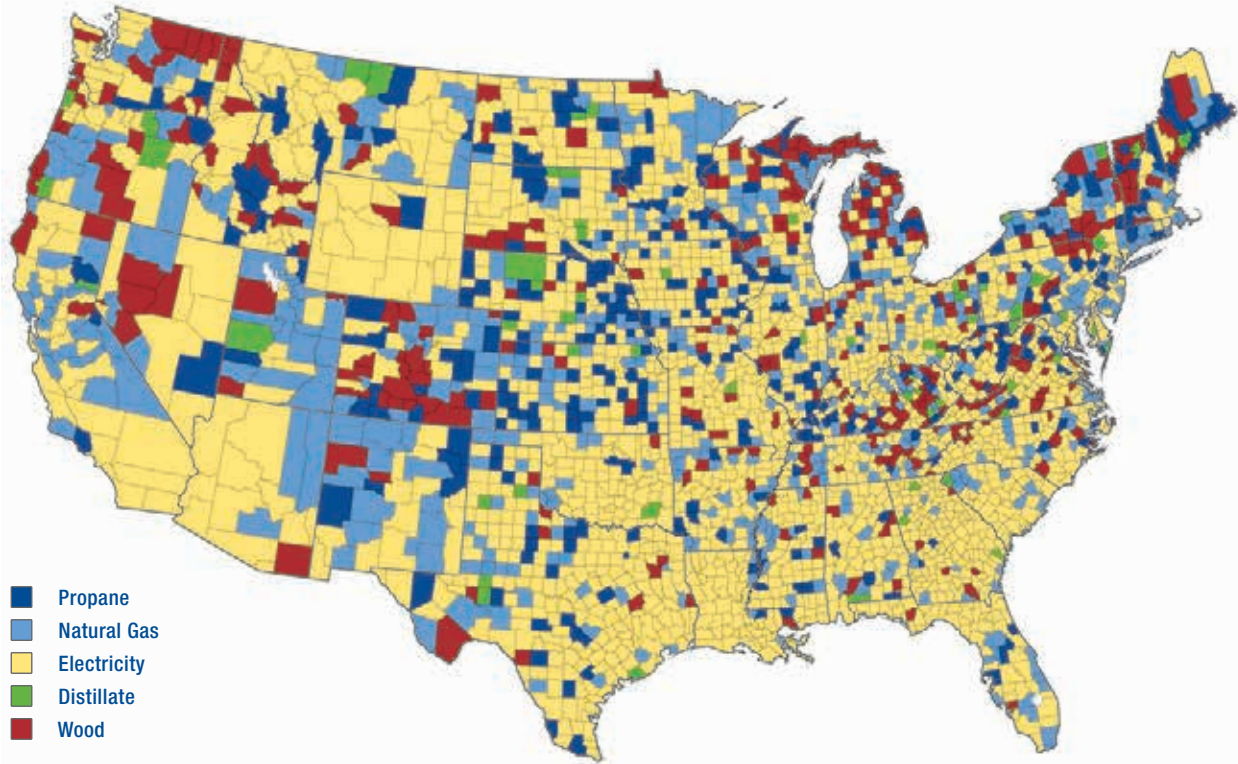


Fig.

I

Fuel with Largest Market Share Losses between 2009 and 2011 in Counties where Propane Gained Market Share

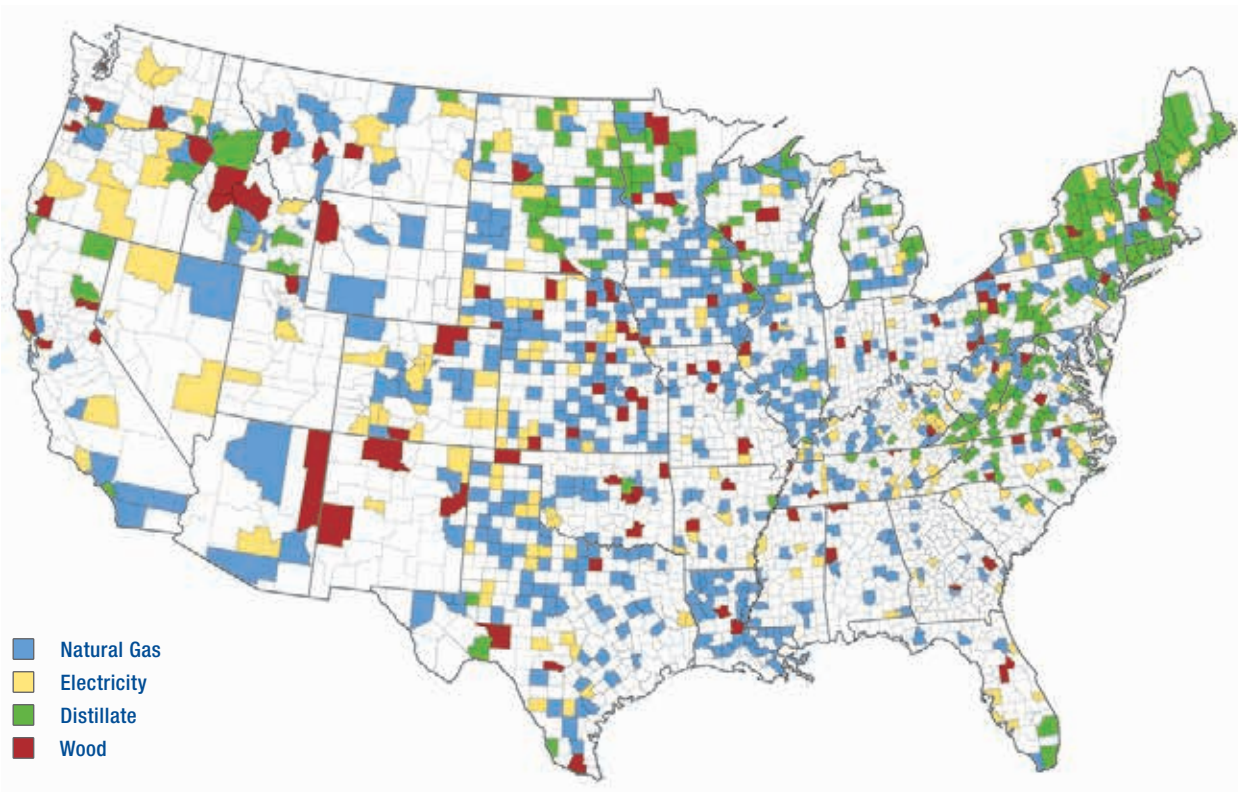
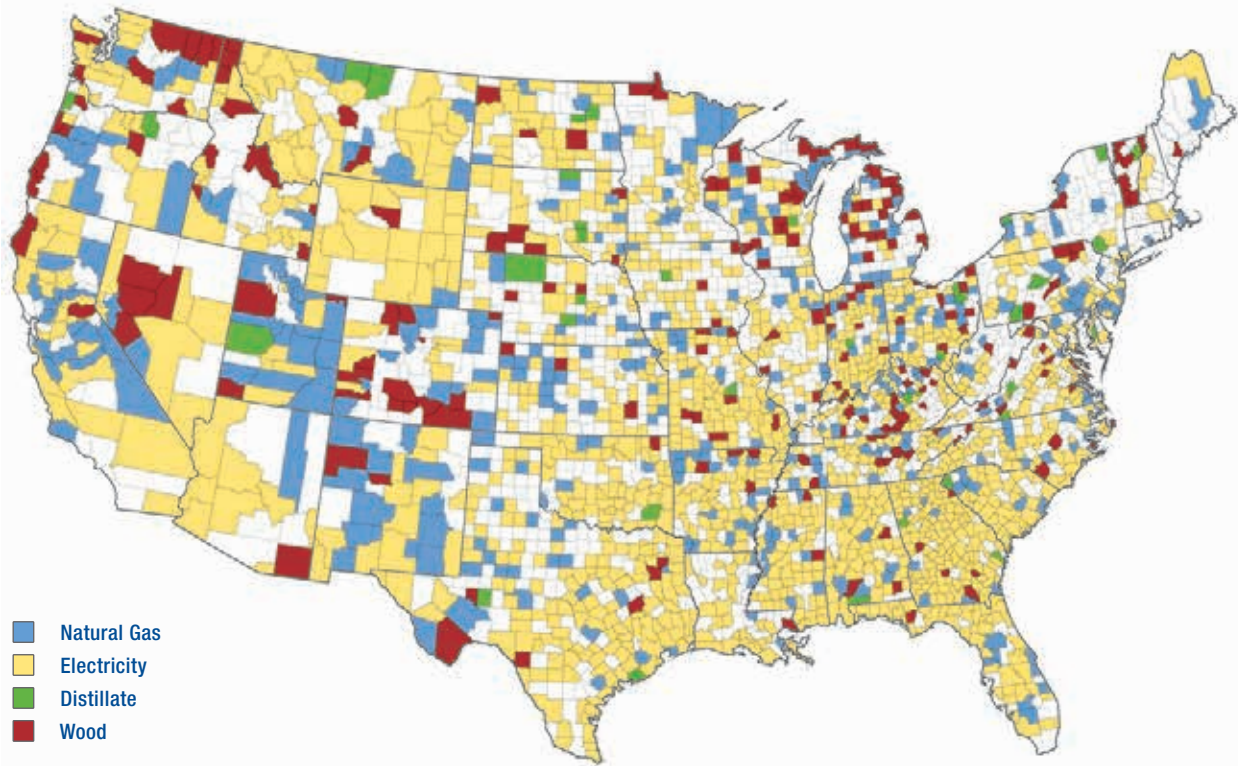


Fig.

J

Fuel with Largest Market Share Growth between 2009 and 2011 in Counties where Propane Lost Market Share



In more than 71% of the 2,012 counties where propane lost market share between 2009 and 2011, electricity was the fastest growing residential space heating fuel (see map in Figure J above). Much of the loss in market share to electricity has occurred in regions of the country, including the Midwest and Southeast, where electricity supply is dominated by coal-fired power generation. These regions are subject to increases in electricity prices due to increasing costs of coal power generation associated with more stringent environmental regulations. While these cost increases are unlikely to change the market dynamic in the short term, higher electricity costs after 2015 likely will slow down propane customer losses in these regions.

2.4 Energy Policy

National energy policies, such as alternative fuel and energy efficiency tax credits, make propane applications more attractive in the marketplace. However, these policies are also likely to increase the energy efficiency of propane applications, accelerating a long term

trend that is reducing propane sales per application relative to existing equipment. New energy policies and regulations also have the potential to tilt the playing field in favor of electricity or other fuels in certain applications.

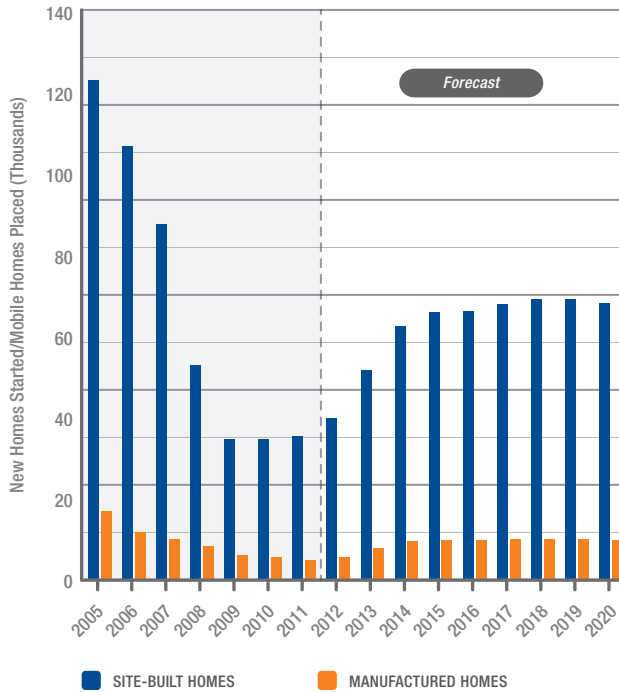
Building and Equipment Efficiency Standards

Existing equipment efficiency standards and building codes have driven a long term decline in average propane sales per customer in the residential and commercial sectors, directly impacting propane sales to both new and existing propane customers. They also promote technological improvements in competing technologies, such as heat pumps.

In 2011, the U.S. Department of Energy finalized rules to increase minimum propane furnace efficiency from 78 percent to 90 percent starting in May 2013 for the 30 northern region states that normally experience more than 5,000 annual heating degree days. This includes the states with most of the existing propane heating load. Tightening of energy efficiency standards and building codes would have a significant impact on the economics and energy use in these applications, and

Fig.
K

New Propane Heated Households



Source: U.S. Census Bureau, Survey of Construction 2000 - 2011, American Housing Survey, American Community Survey, ICF Estimates

would be expected to accelerate the recent decline in propane use per customer for residential heating customers. However, legal challenges to this rule have delayed implementation.⁴ Even with the delay in the implementation of the new standards, existing standards are expected to result in a continuing decline in average propane use per residential customer of around one percent per year.

The national policy focus on energy issues, including energy security, energy efficiency, and emissions, is likely to result in greater promotion of high-efficiency electric appliances. The propane industry can expect to see significant expansion in the number of utility-sponsored programs that provide incentives for high-efficiency conventional heat pumps and GHPs, and high-efficiency 100 percent electric homes in many regions of the country.

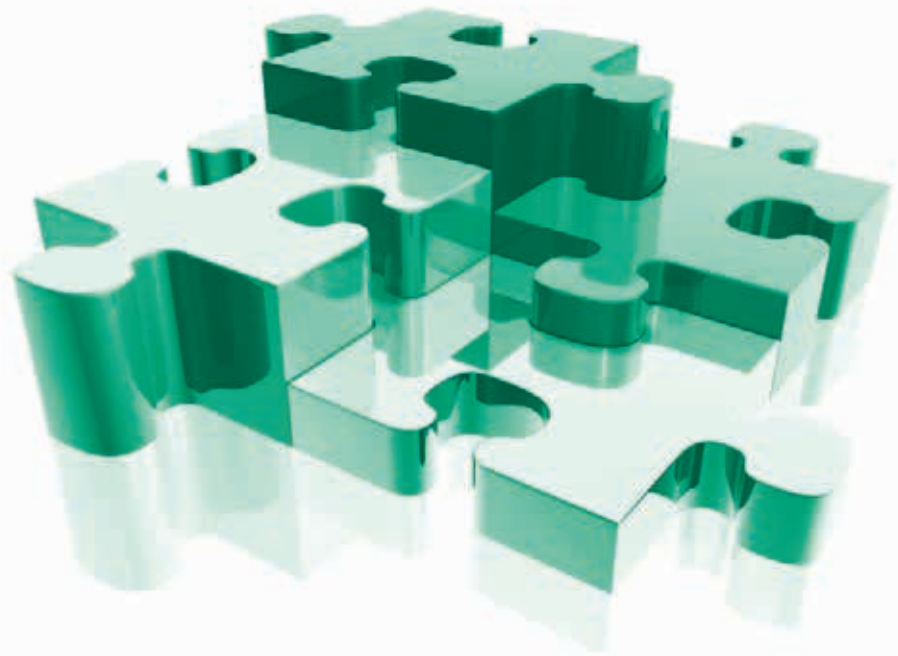
Alternative Motor Fuel and Infrastructure Tax Credits

The federal alternative fuel excise tax credit provides a significant financial incentive for the use of propane as a motor vehicle fuel. This tax credit of \$0.50 per gallon expired at the end of 2011, but was retroactively extended to apply to propane used to operate propane-powered vehicles through December 31, 2013. The federal alternative fuel infrastructure tax credit was also reinstated in January 2013 and provides up to 30 percent of the cost of a qualified propane refueling facility, not to exceed \$30,000, through the end of 2013. Currently these tax credits are subject to renewal every year.

The propane industry is promoting the Propane Gas Act to extend these fuel tax credits through 2016, but the future of this proposal remains uncertain. The biofuel, electric, and natural gas industries are also aggressively pursuing these markets, and can be expected to substantially outspend the propane industry on vehicle development, marketing, and lobbying. Without aggressive industry support, future changes in federal and state energy policies may favor these other alternative fuels relative to propane. Long term stability of the tax credits would improve market acceptance of propane vehicles, leading to an increase in the ICF forecast of propane vehicle sales.



⁴ In January, 2013, the U.S. DOE proposed delaying implementation of these standard in response to the legal challenges. Approval of this proposal likely will delay implementation of the new standards for several years.



3 Overview of Key Propane Markets

I 3.1

Residential Markets

Residential demand represents almost 60 percent of total consumer propane sales. The residential sector is highly regional and market specific. Even though the propane industry added more than one million new residential propane heating customers through new construction and new manufactured housing placements between 2000 and 2011, the total number of propane heated manufactured homes has been declining since 2001, and the total number of site-built heating customers has been declining since 2005.

Growth in the Northeast is offset by losses in the South, while growth in the propane market share in new site-built housing construction has been offset by losses in manufactured housing. In addition, average residential propane demand per customer has been declining due to improvements in energy efficiency and conservation.

The decline in the number of space heating customers, combined with improvements in efficiency and declining use per customer has resulted in a significant long term decline in propane sales in the residential sector (see Figure L).

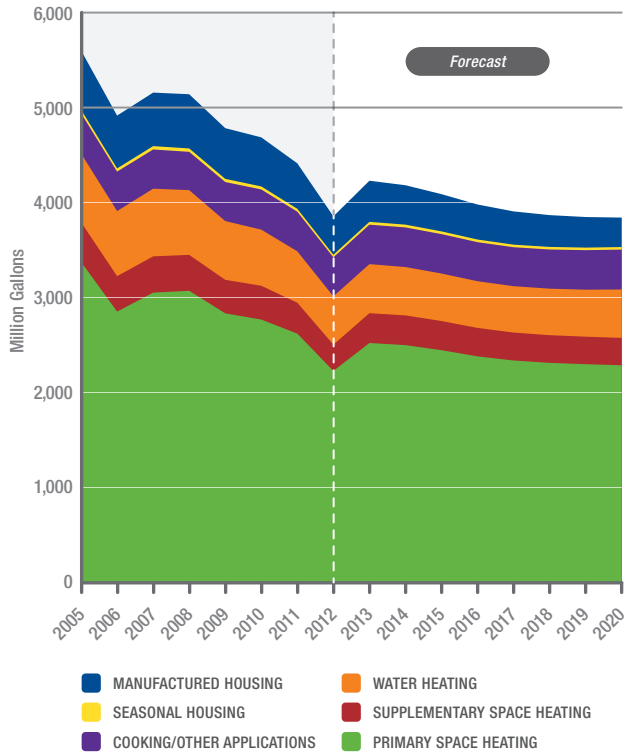
Residential Demand Outlook

Under steady-price conditions, the long term trend toward increased energy efficiency is expected to result in a continued decline in average propane sales per residential customer at an average of about one percent per year. Dramatic rises in heating fuel prices, such as those experienced in 2008 and 2011, accelerate this trend, driving efficiency gains at as much as twice the long term trend rate. Declines in prices, such as those experienced in 2012, slow down improvements in efficiency in the short term, but do not affect the longer term trend. Adding new residential customers through new construction represents one approach to offsetting the losses in load due to efficiency improvements. However, the residential new construction market remains depressed, with new housing starts only slowly rebounding from their 2009 lows. As such, housing starts are unlikely to reach recent housing boom levels in the foreseeable future, and we anticipate that improvements in efficiency will more than offset growth from new construction.

Part of the downturn in housing starts has been offset by modest growth in propane cooking and water heating markets. Maintaining and growing share in these markets will help position propane to capitalize on an eventual rebound in new construction.

Fig.

L Residential Propane Demand Forecast by End Use



Overall, residential propane demand is expected to rebound in 2013 due to a return to more normal weather. Thereafter, demand is expected to fall slowly through 2015 as any growth resulting from the start of the economic recovery is offset by continued decreases in consumption due to efficiency gains. After 2015, residential demand is expected to continue to fall slowly. However, demand will depend largely on propane consumer price trends and the competition with electricity.

Opportunities in the Residential Sector

Propane remains a premium fuel in the largest and most expensive new homes that are not on the natural gas main. Owners of custom and upscale homes built off the gas main want the convenience of gas for cooking, heating, and other needs. These customers base their heating and appliance decisions on value rather than cost, and the propane industry has effectively promoted the value of propane throughout the range of residential applications.



Even in the southern sections of the country, where propane heating market share has been declining, propane cooking and water heating have been increasing, as the more upscale residences in these regions continue to demand the convenience and comfort of gas for these applications.

However, the recent increase in propane prices, combined with an increased sensitivity to first-cost issues in the homes that have been built, resulted in a noticeable decline in propane space heating market share in new construction in 2010 and 2011.

Existing customers represent a significant potential market for new propane applications. For example, many customers use propane for cooking, water heating, or clothes drying, but not for space heating. Other customers use propane for space heating, but not for water heating or cooking. More than 2.5 million existing propane customers could convert to propane heat, including more than 1 million customers in the Northeast who are likely heating with fuel oil. Almost 4 million existing propane customers do not heat water with propane, and almost 4 million existing propane customers do not cook with propane. Increasing the number of propane applications used by existing propane customers may be the most efficient way to offset declines in use per customer from improvements in energy efficiency.

3.2 Commercial Sector Outlook

The commercial sector accounts for about 20 percent of the overall consumer propane market. The near term forecast for propane demand shows stable non-weather driven consumption in the commercial sector through 2012, with the impact of modest economic growth offset by the long term impacts of higher propane prices. Weather-sensitive demand declined in 2011 and 2012 due to warmer than normal temperatures, but is expected to rebound in 2013. This is followed by very modest growth in 2013 through 2015 linked to a rebounding economy. In the longer term, projected growth in commercial propane sales will be driven by growth in commercial activity.

The commercial sector is a very diverse market, with a much wider range of customer types and end-uses than other sectors. The market also differs widely by region

Fig. M Propane Space Heating Market Share in Commercial Markets

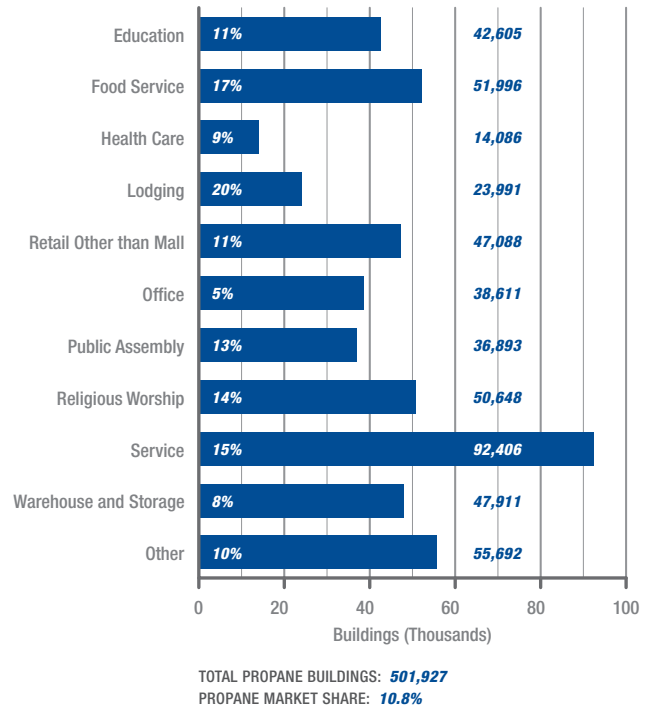
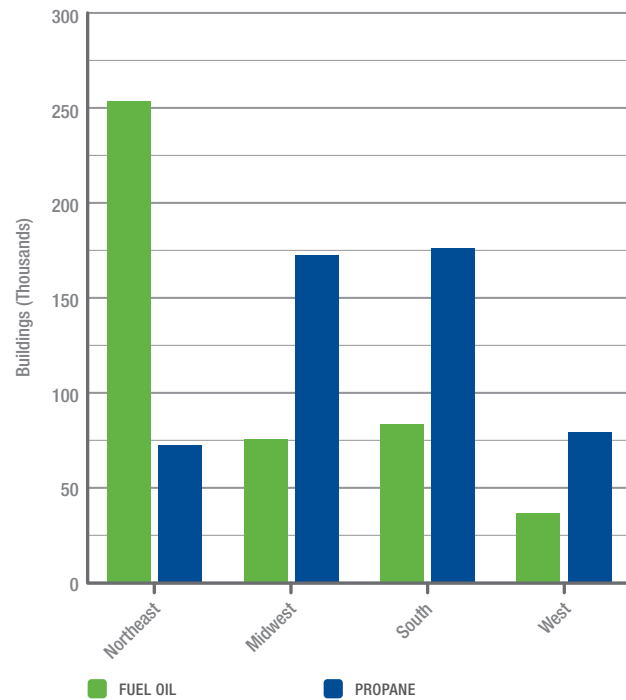


Fig. N Propane & Fuel Oil Use: All Applications



in a manner similar to the residential sector. Recent PERC research into the commercial sector indicates that there is significant opportunity to expand sales into this market. Understanding the regional differences in fuel use and the variety of commercial propane market segments (e.g., schools, fast food restaurants, and houses of worship) can lead to new opportunities.

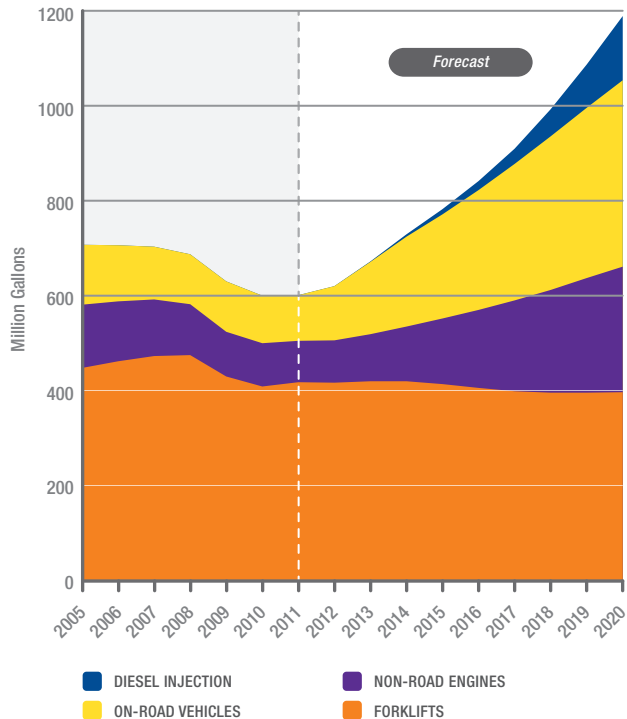
One of the key applications - and region-specific opportunities - in the commercial sector will be conversion of fuel oil heating customers. Fuel oil currently dominates the commercial heating market in the Northeast. Many potential propane heating customers already use propane for cooking and other purposes, presenting the propane industry with near term conversion opportunities with existing propane customers. The market share for fuel oil in new commercial construction has already declined substantially because of permitting issues with fuel oil storage tanks, leading to additional market opportunities for propane in new commercial construction. While fuel oil use is not as predominant in the Midwest and Western regions, there remain significant pockets of fuel oil use in the commercial sector in these regions that provide opportunities for propane.

Other key opportunities include promotion of tankless water heaters in a variety of commercial segments, including the lodging and resort industry, and in institutional and educational settings. In the commercial sector, tankless water heating can have both first cost and operating cost advantages relative to electric water heating when electric system cost savings and building space savings are fully accounted for.

3.3 Internal Combustion Engine Outlook

The internal combustion engine market offers long term potential for large growth in propane sales. ICF is projecting propane sales in this market area to double from about 600 million gallons in 2011 to almost 1.2 billion gallons in 2020. In the short term, a steep recession-driven decline in propane use in the forklift market could be partially offset by modest growth in demand for on-road vehicles, commercial mowers, and stationary engines. The increase in vehicles and applications available to the market, combined with an improvement in the propane/gasoline price relationship and an economic recovery, should lead to modest demand growth in 2012 through 2013 (see Figure O).

Fig. O Internal Combustion Engine Propane Consumption



After 2013, growth in new applications has the potential to significantly expand propane sales, particularly in the on-road vehicle and mower markets.

On-Road Vehicles

Propane provides a viable alternative to gasoline and diesel fuel in the on-road vehicle market, and has significant environmental advantages relative to both. In addition, recent changes in the long term relationship between propane and both gasoline and distillate fuel prices has positioned propane as a potential lower cost alternative to both gasoline and diesel powered vehicles.

In the past few years, propane vehicle sales have been constrained by the limited number of new propane vehicles and aftermarket vehicle conversion systems available to the market. Recent investments by PERC, ROUSH CleanTech, Bluebird Bus, CleanFUEL USA, and others have led to the introduction of a number of new propane-powered vehicles in the last three years. Industry partnerships with additional original equipment manufacturers (OEMs), including the existing PERC partnership with Freightliner Custom Chassis, have

the potential to rapidly expand the number of vehicles available to the market in the longer term (see Figure P).

The recent introduction of a series of new propane-powered vehicles is expected to generate a near term increase in propane sales in this market. However, the propane industry will need to overcome significant market hurdles to maximize sales in this sector.

In the past, much of the alternative fuel market has been driven by customer preferences to be seen as “green,” as well as the need to comply with alternative fuel objectives rather than for cost or performance reasons. In addition, much of the alternative fuel market has been sustained by vehicle⁵ and fuel tax incentives. While this has helped propane in the past, the current emphasis on electric and natural gas vehicles in the national policy debate increases the potential to leave propane out of the alternative fuel conversation in the future. However, given the current disparity between propane and gasoline/diesel prices, propane vehicles make sense on a straight economic basis in many applications, including school buses, shuttles and taxis, delivery vehicle fleets, law enforcement fleets, and other fleet vehicle applications where vehicles are based at a single location.

To accelerate penetration of propane into the on-road vehicle market, the industry needs to help increase the number of vehicles available and encourage the long term extension of tax credits on equipment capital and fuel costs that are scheduled to expire at the end of 2013. Additional efforts should focus on educating consumers on the economic and environmental benefits of propane vehicles, reducing the regulatory burden for small, low-volume manufacturers and converters, and ensuring recognition of propane’s environmental and energy security benefits in the national environmental policy debate.

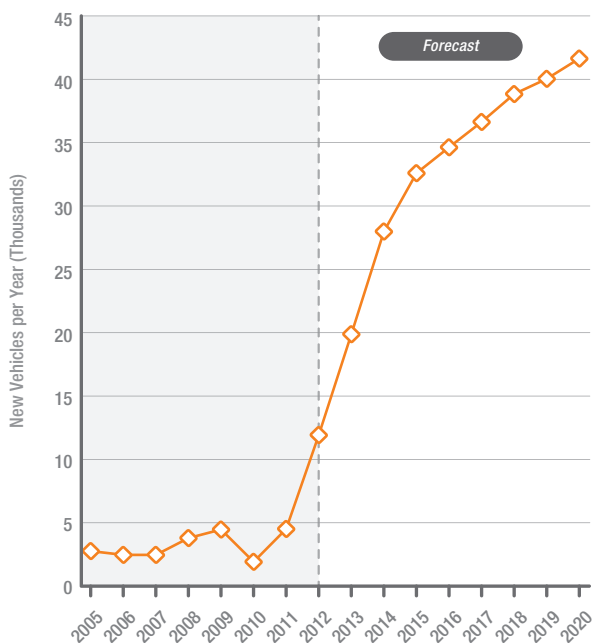
Forklifts

The forklift market is a key market for the propane industry, representing about five percent of total odorized propane sales. However, unless the forklift industry is able to develop a new generation of propane forklifts with lower operating costs and better emissions characteristics than the currently available models, and

Fig.

P

Projected Propane On-Road Vehicle Sales



is able to market the new generation of propane lift trucks at a competitive price, ICF projects that propane sales to the forklift market will decline slowly for the foreseeable future.

The recent recession caused a substantial decline in the overall size of the forklift market. In addition, the combination of fuel price and technology changes has resulted in a loss of propane market share in this market. While demand for new lift trucks experienced healthy growth in 2011, the propane share of new forklift sales declined. Before the recent recession, propane forklifts represented more than 60 percent of the market for class four and five lift trucks. In 2011, the propane marketshare fell to less than 50 percent of the market.

Electric lift trucks represent the primary threat to propane in this market. The electric battery, battery charger, and motor technologies incorporated into electric lift trucks have continued to improve over time. In addition, the increase in the cost of propane relative to electricity has increased the expected operating costs of propane forklifts relative to their electric competitors.

⁵ Tax credits for the purchase of propane vehicles expired at the end of 2011, and have not been renewed.

Other Non-Road Engines

The non-road engine market provides large growth opportunities for the propane industry, although cost, regulatory, and market structure issues must be resolved to reach this market's full potential. Based on technology available today, three applications are especially promising:

Commercial Lawn Mowers: The commercial propane mower market has the potential to generate significant growth in propane demand, possibly rivaling propane forklifts as the largest market for propane engines. Currently, there are about one million commercial lawn mowers in service, with the potential to consume more than one billion gallons of propane. More than 12 OEMs have already brought propane mowers into the market.

Propane mowers burn cleaner and result in fewer emissions over competing gasoline-fired equipment and should have a longer effective equipment life and be less costly to maintain. In most regions, fuel costs are also likely to be lower with propane. However, propane mowers currently available cost considerably more to purchase than comparable gasoline equipment. In addition, there is a significant structural cost to commercial customers of switching from gasoline to propane. Switching requires changes in refueling and servicing practices, as well as employee and service personnel training practices. Maintaining a fleet using two different fuels at the same time also increases costs, while the cost of replacing an entire fleet of mowers at one time is likely to be prohibitive to many potential customers.



As a result, the distribution and servicing structure for propane mowers has developed at a slower pace than the technologies themselves, and the OEMs are not aggressively promoting the available propane models. To address these market issues, the propane industry will need to take a larger role in marketing, supporting and, potentially, financing the propane mower market if the propane sales growth potential available in this market is to be achieved.

Irrigation Pumps: Irrigation pumps provide a high-volume, high-load factor market for propane. While the number of propane pumps in use declined between 2000 and 2010, this trend appears to be reversing. The new propane engines becoming available in this market are substantially cleaner and more efficient than the previous generation of irrigation engines. The major irrigation markets in the Midwest have access to relatively low cost propane, providing the potential for significant cost advantages relative to diesel fuel and gasoline. Environmental advantages of the new generation of propane engines should also stimulate growth in markets in California and the western states.

Generators: The next generation of propane generators has the potential to turn backup, portable, and remote power generation into a major source of propane sales. Kohler, Generac, and other manufacturers are bringing a variety of propane fueled generators into the

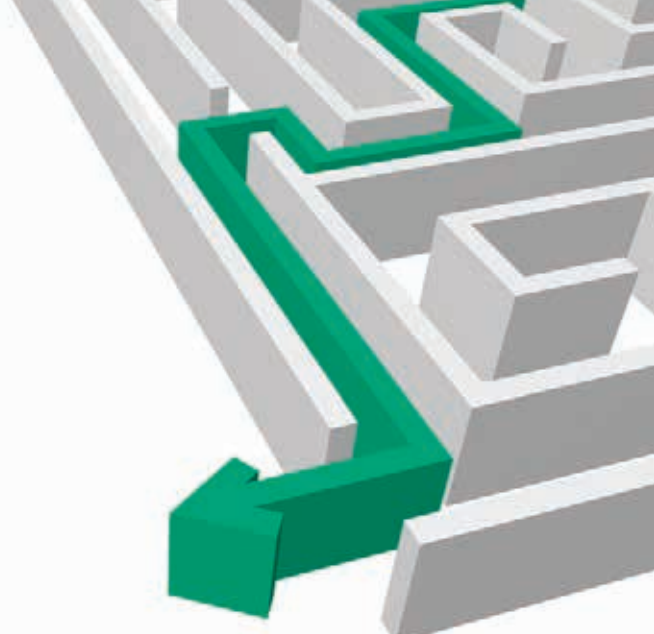
market in the next two years. These units should be quieter and cleaner, and have lower maintenance costs relative to competing gasoline and diesel fuel options, and appear likely to be offered at similar price points. These units should be competitive in the backup power generation market, and could be used for electricity peak shaving in some markets with particularly high time-of-use electricity rates. In addition, the propane industry appears well situated to generate significant new propane sales in the towable generator market due to increased costs of diesel generation associated with new emissions regulations on diesel engines.

Diesel Fuel Displacement

Changes in diesel fuel prices relative to propane, as well as increases in diesel engine costs necessary to meet more stringent environmental regulations, provide the propane industry with a major opportunity to displace diesel fuel use in a wide variety of different applications. The potential size of these markets is astounding. Current diesel fuel consumption in the U.S. is the equivalent of 80 billion gallons of propane.

The propane industry has a number of applications available today capable of competing with diesel engines, including several of propane vehicles, propane irrigation engines, and portable power generation applications. Other applications, including the diesel co-injection technologies, are nearing market availability. However, there are currently large sections of the diesel market where no viable propane alternative is available or under development. Identifying the most attractive markets and applications, and developing the applications needed to serve these markets, will be an important step in growing propane markets in the next few years.





4 Key Propane Industry Challenges and Opportunities

Achieving future sustained growth of propane sales will depend on the industry's success in responding to the leading market challenges and opportunities likely to be faced in the next few years. Key propane industry challenges and opportunities include:

- Maintaining current markets.
- Understanding and taking advantage of regional market segmentation.
- Capitalizing on the changing relationship between propane and gasoline/distillate prices.
- Participating in the national energy and environmental policy and regulatory process.

4.1

Maintaining Current Markets

The biggest challenge facing the propane industry over the next 10 years may be maintaining current market share in the residential and commercial sectors. These two sectors currently account for more than 75 percent of total consumer propane sales. These sectors offer a variety of growth opportunities, both in increasing market share for existing applications, including conversion of heating oil applications to propane, and in commercialization of new technologies such as residential tankless water heaters, portable and backup generators, and commercial propane-fired heat pumps and CHP units. However, the threats to these markets remain formidable:

- Propane use per customer has fallen substantially and is expected to continue declining in response

to higher prices and improvements in building and equipment efficiency.

- Electric heat pump technology is becoming more efficient and economical and is likely to continue to erode propane heating market share in many regions.
- Propane prices have increased substantially relative to electricity in most regions, and this price disparity is projected to continue.
- Since 2000, the propane industry has lost more than 350,000 manufactured home customers due to the overall collapse of the manufactured home market and to electricity inroads into new units. This trend is expected to continue.
- Growth in natural gas supply is leading to lower natural gas prices and expansions in natural gas distribution systems that lead to conversions of existing propane customers to natural gas.

Given the expected improvements in electric heating technology, and the expected promotion of electricity as a “green” energy source by the electric power industry, maintaining existing propane customers is likely to become even more difficult. Preserving the current customer base will require an aggressive and coordinated effort by the propane industry. The major propane applications in these sectors have significant non-cost advantages over competing fuels and

technologies - advantages like warmer heat and the convenience of gas that add value for customers. The propane industry will need to emphasize this value proposition to capture high-opportunity markets and offset inevitable losses in markets that are driven entirely by cost rather than value.

4.2 Understanding and Taking Advantage of Regional Market Segmentation

Market threats and opportunities facing the propane industry differ by region and location. The map in Figure Q below shows the wide distribution of propane residential heating customers. With the exception of the West Coast and the South, where electricity holds most of the market, and New England where fuel oil has the highest share of the residential heating market, propane has more than 10 percent of the residential space heating market in most counties. However, the distribution varies widely depending on climate, energy prices, and availability of natural gas.

Even within specific geographic regions, there can be widely varying differences in weather patterns, customer lifestyles, electricity prices, and competition from other technologies and fuels. While many of the regional differences are concentrated in the residential and commercial sectors, differences in state regulations and electricity prices also affect propane in other demand sectors. Hence, propane industry marketing strategies that can be tailored to specific regional conditions and requirements will be more successful than a one-size-fits-all national approach.

In the residential sector, regions with significant propane market share, and significant residential new construction, are likely to provide the majority of new opportunities for propane. The map in Figure R illustrates where these areas are located. While there is good market opportunity for propane in many counties around the country, the majority of high growth markets where propane is likely to capture a significant share of the new construction and renovation markets are located in the Northeast, Upper Midwest, and Rocky Mountain regions.

Fig.

Q Propane Space Heating Market Share in 2011

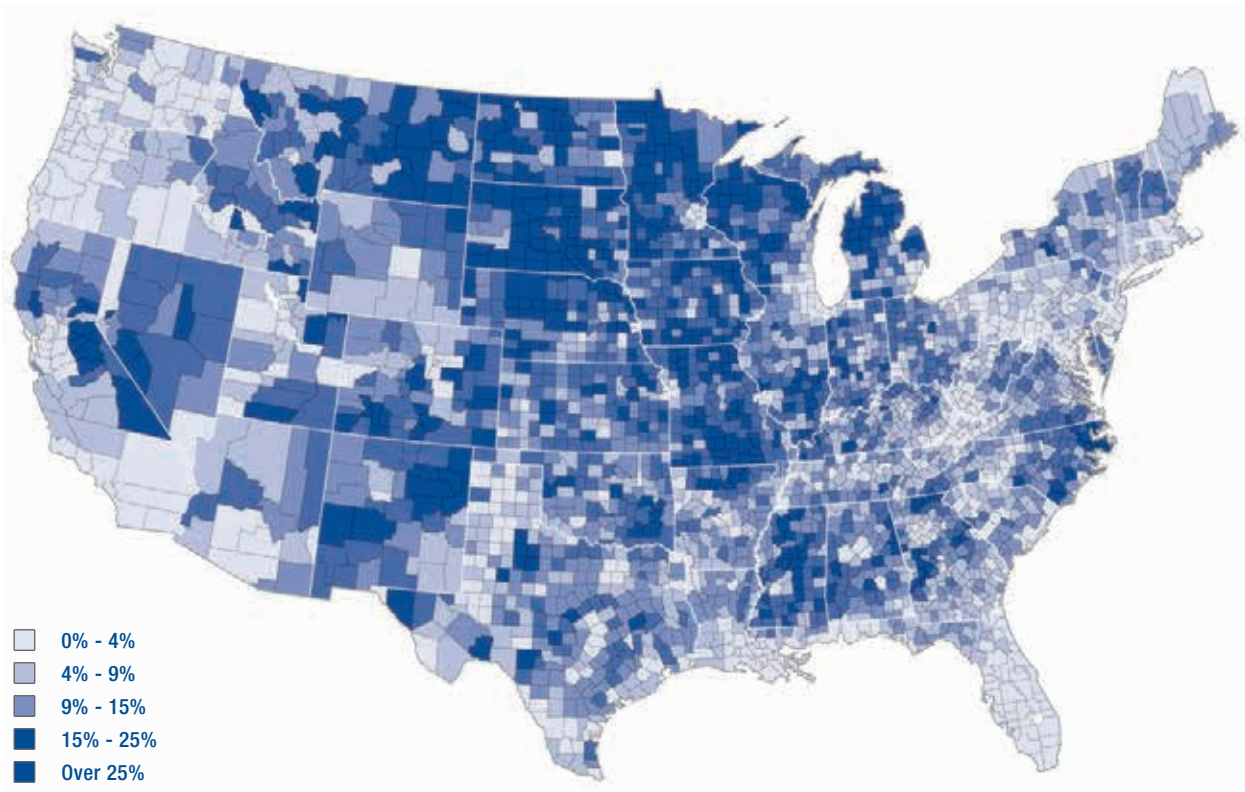
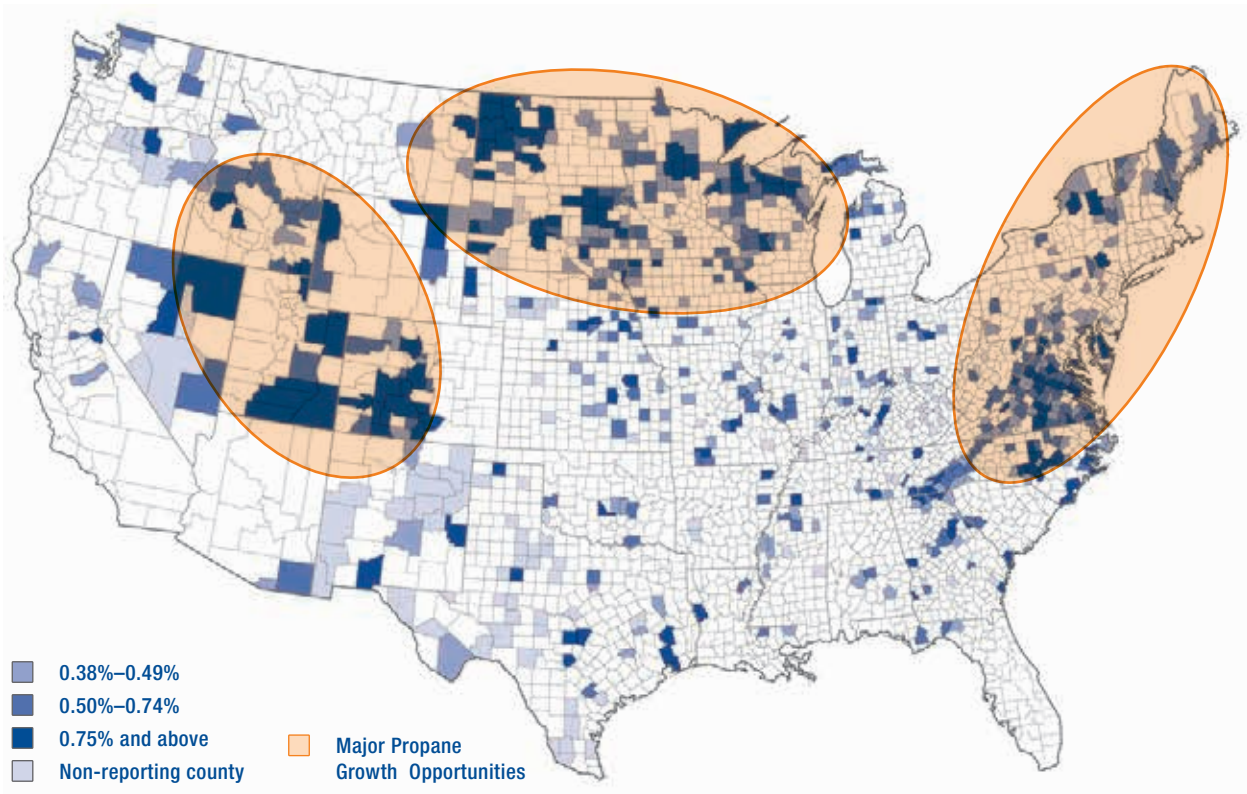


Fig.

R

Counties with More Than 10% Residential Propane + Heating Oil Market Share and Above Average New Housing Construction Activity



4.3

Maximizing the Opportunities Created By Changes in Relationship between Propane and Gasoline/Distillate Prices

When multiple forms of energy are available for the same function, price becomes a prime consideration in users' energy choices. Given projected long term shifts in world energy markets, propane prices are expected to become more competitive relative to diesel and fuel oil prices over time. This change is expected to create unique opportunities in the residential and commercial heating markets in the Northeast and Midwest, as well as in the full range of diesel engine markets.

However, it is not clear that potential customers will recognize propane's operating cost advantage in heating and engine fuel applications. Encouraging current oil heating customers to invest in new, more efficient propane furnaces will require the propane industry to make a compelling case for long term consumer benefits. Communicating the benefits of propane is vital, but inducing customers to switch fuels may also require

facilitating equipment conversions with up-front financing, as well as other steps to simplify the process. Likewise, in the internal combustion engine market, consumers may not be familiar with the new, more efficient generation of propane engines in non-road applications, and may have had only limited exposure to on-road propane vehicles. A major consumer education campaign can help to significantly increase consumer awareness and eventual sales of propane-powered vehicles.

Another challenge in the competition of propane with other engine fuels is that the number of propane applications for on- and off-road vehicles is currently limited. The cost of developing and introducing new propane vehicles is very high and PERC-funded applications that have been under development for several years are only now starting to reach the market. The necessary capital for new vehicle development is unlikely to come from the motor vehicle industry until manufacturers believe the market will support a high volume of new vehicle sales. Consequently, this market may require significant long term financial support by the propane industry before it can become self-sustaining.

4.4

Leveraging the Environmental and Energy Security Benefits of Propane

Propane is a cleaner-burning, lower-carbon fossil fuel than other petroleum-based products such as distillate fuel oil, kerosene, and gasoline. Propane is also a domestically produced fuel and the use of propane helps improve U.S. energy security. In contrast to natural gas, where the principal component is methane - a greenhouse gas itself - propane has a near-zero direct global warming potential, making it a preferred fuel over natural gas in some applications.

PERC and its partners are developing technologies and products that build on propane's emissions and supply benefits in applications such as distributed generation, agriculture, and transportation. However, these benefits and applications are not widely recognized by decision-makers in the current national energy and environmental policy debate. Federal and state energy and environmental policy decisions, along with the resulting tax policies and regulations on energy use, are going

to play a significant role in either promoting or inhibiting use of propane in a variety of markets. If the benefits of propane are recognized and considered during energy and environmental policy discussions, propane is likely to benefit from the resulting policies and initiatives. But if these benefits are not effectively communicated and recognized, propane is likely to be regulated the same as gasoline and distillate fuel oil, which could considerably limit potential propane market growth.

As a result, the propane industry - through the appropriate national and state trade associations and companies - needs to be actively involved in the federal and state energy and environmental policy and regulatory process. The industry's companies and appropriate trade associations must engage policymakers in regulatory discussions of specific priority market development targets, such as alternative transportation fuels and distributed generation, to ensure that propane is adequately considered when new energy policies are drafted. This makes it essential for the propane industry to understand the relevant issues and policy options, know the critical stakeholders and their positions, and be seen as an important stakeholder and resource by the organizations and agencies drafting new policies and regulations.



Final Thoughts

North American energy markets in general, and propane markets in particular, are in the midst of a period of profound change. Existing propane markets face growing competition from electricity and natural gas, and existing demand is falling due to improvements in energy efficiency and in response to increases in propane prices. However, the propane industry also has an unprecedented opportunity to grow demand in a broad range of engine fuel markets as well as in markets where propane competes with fuel oil.

The rapid growth in domestic propane production is expected to support future domestic propane prices at a level below international propane prices. While ICF anticipates a modest rebound in the Mt. Belvieu to crude oil price relationship relative to year end 2012 propane prices, we anticipate the ceiling on domestic propane prices will be set at the world price of propane minus transportation costs to international markets, rather than the world price of propane plus transportation costs that set the floor on domestic propane prices during the periods when the U.S. was a major propane importer. As a result, propane prices are expected to remain very competitive relative to diesel and gasoline. This, in turn, should make propane a much more attractive alternative to conventional transportation fuels. The fuel's clean-burning and "100% domestic" production profile should provide further impetus to its expanding role in America's fuel mix.

In addition, the increase in domestic propane production from natural gas liquids provides the propane industry with the opportunity to brand itself as a clean, domestic, and secure energy source.

Taking advantage of the market opportunities and minimizing the impact of the market threats will require concerted action by the industry as a whole, including investments in new technologies and new business models.

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